

What is claimed is:

1 1. A transmission and reception system comprising a transmission
2 device and, a receiving device, and a communication pathway between said
3 transmission device and said receiving device, said transmission device
4 comprising:

5 (1) convolutional coding means for convolution-coding input data,
6 and outputting convolution-coded data;

7 (2) puncturing means for puncturing said convolution-coded data
8 using puncturing patterns, and outputting punctured data; and

9 (3) modulation / transmission means for modulating and transmitting
10 said punctured data , and

11 said receiving device comprising:

12 (1) reception / demodulation means for receiving and demodulating
13 a signal transmitted by said transmission device, and outputting demodulated data;

14 (2) depuncturing means for depuncturing said demodulated data, and
15 outputting depunctured data;

16 (3) combining means for combining said depunctured data, and
17 outputting a result of combining; and

18 (4) convolutional decoding means for convolution-decoding said
19 result of combining, and outputting a decoded data.

1 2. A time-diversity transmission and reception system comprising:

2 a transmission device including:

3 (1) convolutional coding means for convolution-coding input data,
4 and outputting convolution-coded data;

5 (2) first multiple puncturing pattern generation means for generating
6 puncturing patterns having an identical puncturing rate, but having respectively
7 different puncturing block patterns;

8 (3) first puncturing means for puncturing convolution-coded data
9 output by said first convolutional coding means by using each of said puncturing
10 patterns supplied by said first multiple puncturing pattern generation means, and
11 outputting punctured data;

12 (4) diversity transmission timing control means for outputting a
13 diversity transmission timing control signal for carrying out transmission for a
14 plural number of times;

15 (5) time-diversity modulation / transmission means for modulating
16 and transmitting, as diversity transmission data, said punctured data output by
17 said first puncturing means in response to said diversity transmission timing
18 control signal, and

19 a receiving device including:

20 (1) diversity reception timing control means for outputting a
21 predetermined diversity reception timing control signal for carrying out reception
22 of a signal transmitted with time diversity transmission;

23 (2) time-diversity reception / demodulation means for receiving and
24 demodulating each of the signals transmitted by said transmission device, in
25 response to said diversity reception timing control signal, and outputting
26 demodulated data;

27 (3) second multiple puncturing pattern generation means for
28 generating puncturing patterns, which are identical to the puncturing patterns
29 generated by said first multiple puncturing pattern generation means;

30 (4) first depuncturing means for depuncturing the demodulated data
31 output from said time-diversity reception / demodulation means by using the
32 puncturing patterns supplied by said second multiple puncturing pattern generation
33 means, and outputting depunctured data;

34 (5) first combining means for combining the depunctured data output
35 by said first depuncturing means, and outputting a result of combining; and

36 (6) first convolutional decoding means for convolution-decoding said
37 result of combining, and outputting decoded data,

38 wherein said time-diversity transmission and reception system
39 executes time-diversity transmission and reception of error-correction code words,
40 obtained by puncturing and convolution-coding information data with the
41 puncturing patterns.

1 3. The time-diversity transmission and reception system according to
2 claim 2, wherein:

3 (1) said demodulated data output by said time-diversity reception /
4 demodulation means are digital values quantized with a predetermined number of
5 bits;

6 (2) said depuncturing carried out by said first depuncturing means
7 includes inserting a middle value between two digital values corresponding to a
8 mark and a space;

9 (3) said combining by said first combining means is a process of

10 addition of a digital value to said series of depunctured data output by said first
11 depuncturing means, symbol by symbol in a unit of block; and

12 (4) said first convolutional decoding means defines Viterbi soft
13 quantization means for executing Viterbi soft decision.

1 4. The time-diversity transmission and reception system according to
2 claim 2, wherein puncturing locations in said puncturing patterns generated by
3 said first multiple puncturing pattern generation means are set in a manner not to
4 overlap among said plurality of patterns.

1 5. The time-diversity transmission and reception system according to
2 claim 2, wherein said first multiple puncturing pattern generation means
3 comprises a first reference matrix generation means for generating a reference
4 matrix for one of said puncturing patterns, and a first matrix conversion means
5 for outputting a different puncturing pattern for each diversity branch by
6 converting at least one of rows, columns and elements of said reference matrix.

1 6. The time-diversity transmission and reception system according to
2 claim 5, wherein said second multiple puncturing pattern generation means
3 comprises second reference matrix generation means having the same function as
4 said first reference matrix generation means, and second matrix conversion means
5 having the same function as said first matrix conversion means with relation to a
6 further reference matrix generated by said second reference matrix generation
7 means.

1 7. A time-diversity transmission and reception system comprising:
2 a transmission device including:

3 (1) convolutional coding means for convolution-coding input data,

4 and outputting convolution-coded data;

5 (2) first multiple puncturing pattern generation means for generating
6 puncturing patterns having an identical puncturing rate, but having respectively
7 different puncturing block patterns;

8 (3) first puncturing means for puncturing convolution-coded data
9 output by said first convolutional coding means by using each of said puncturing
10 patterns supplied by said first multiple puncturing pattern generation means, and
11 outputting punctured data;

12 (4) diversity transmission timing control means for outputting a
13 diversity transmission timing control signal for carrying out transmission for a
14 plural number of times;

15 (5) time-diversity modulation / transmission means for modulating
16 and transmitting, as diversity transmission data, said punctured data output by
17 said first puncturing means in response to said diversity transmission timing
18 control signal, and

19 a receiving device including:

20 (1) diversity reception timing control means for outputting a
21 predetermined diversity reception timing control signal for carrying out reception
22 of a signal transmitted with time diversity transmission;

23 (2) time-diversity reception / demodulation means for receiving and
24 demodulating each of the signals transmitted by said transmission device, in
25 response to said diversity reception timing control signal, and outputting
26 demodulated data;

27 (3) second multiple puncturing pattern generation means for

28 generating puncturing patterns, which are identical to the puncturing patterns
29 generated by said first multiple puncturing pattern generation means;

30 (4) first depuncturing means for depuncturing the demodulated data
31 output from said time-diversity reception / demodulation means by using the
32 puncturing patterns supplied by said second multiple puncturing pattern generation
33 means, and outputting depunctured data;

34 (5) weighting / combining means, replacing said first combining
35 means, for combining after weighting the depunctured data output by said first
36 depuncturing means according to the reception level for each of every diversity
37 branches stored in said reception level memory means, and outputting a result of
38 combining.

39 (6) first convolutional decoding means for convolution-decoding
40 said result of combining, and outputting decoded data,

41 wherein said time-diversity transmission and reception system
42 executes time-diversity transmission and reception of error-correction code words,
43 obtained by puncturing and convolution-coding information data with the
44 puncturing patterns

45 (7) reception level memory means for measuring a reception level at
46 every timing of diversity reception in said time-diversity reception / demodulation
47 means, and storing a result of measurement

1 8. A time-diversity transmission and reception system, comprising a
2 transmission device and a receiving device, said transmission device comprising:

3 (1) first convolutional coding means for outputting input data by
4 convolution-coding said data;

5 (2) first multiple puncturing pattern generation means for generating
6 puncturing patterns having an identical puncturing rate, but different in block
7 pattern of puncturing with one another;

8 (3) first puncturing means for puncturing convolution-coded data
9 output by said first convolutional coding means by using each of said puncturing
10 patterns supplied by said first multiple puncturing pattern generation means, and
11 outputting punctured data;

12 (4) first code division multiplex signal transmission means for
13 transmitting said punctured data by code division multiplexing simultaneously,
14 and

15 said receiving device comprising:

16 (1) first code division multiplex signal reception means for receiving
17 and demodulating a signal transmitted with said code division multiplexing, and
18 outputting multiplexed demodulated data;

19 (2) second multiple puncturing pattern generation means for
20 generating puncturing patterns, which are identical to the predetermined plural
21 form of puncturing patterns generated by said first multiple puncturing pattern
22 generation means;

23 (3) first depuncturing means for depuncturing the demodulated data
24 corresponding to the predetermined number of diversity receptions output from
25 said first code division multiplex signal reception means by using the puncturing
26 patterns supplied by said second multiple puncturing pattern generation means,
27 and outputting depunctured data;

28 (4) first combining means for combining the depunctured data output

29 by said first depuncturing means, symbol by symbol in a unit of block, and
30 outputting a result of combining; and

31 (5) first convolutional decoding means for convolution-decoding said
32 result of combining, and outputting a decoded data,

33 wherein said time-diversity transmission and reception system
34 executes code division multiplex transmission and reception of error-correction
35 code words obtained by puncturing and convolution-coding identical series of
36 information data with the puncturing patterns.

1 9. A transmission and reception system according to claim 1,
2 including a transmission device comprising:

3 (1) a second convolutional coding means for convolution-coding and
4 outputting said input data;

5 (2) first puncturing pattern generation means for generating a
6 puncturing pattern having an identical puncturing rate, but different in block
7 pattern from a puncturing pattern generated in any other of said plurality of
8 transmission devices;

9 (3) second puncturing means for puncturing a series of convolution-
10 coded data output by said second convolutional coding means by using the
11 puncturing pattern supplied by said first puncturing pattern generation means, and
12 outputting a series of punctured data;

13 (4) first transmission control means for outputting information of a
14 predetermined transmission timing and a predetermined transmission frequency
15 for said transmission device to execute a transmission; and

16 (5) first modulation / transmission means for modulating and

17 transmitting said series of punctured data in response to said information of
18 transmission timing and transmission frequency, and

19 and a receiving device comprising:

20 (1) first reception control means for supplying information of a
21 predetermined reception timing and a predetermined reception frequency for
22 carrying out reception of individual signals transmitted by said plurality of
23 transmission devices in said predetermined transmission timing and said
24 predetermined transmission frequency;

25 (2) first reception / demodulation means for receiving and
26 demodulating the signal transmitted by each of said transmission devices in
27 response to information of said predetermined reception timing and said
28 predetermined reception frequency supplied from said first reception control
29 means, and outputting demodulated data;

30 (3) third multiple puncturing pattern generation means for generating
31 puncturing patterns, which are identical to the individual puncturing patterns of
32 said plurality of transmission devices;

33 (4) second depuncturing means for depuncturing each of the
34 demodulated data output by said first reception / demodulation means by using a
35 puncturing pattern that is identical to the one used by said transmission device
36 among said puncturing patterns supplied from said third multiple puncturing
37 pattern generation means, and outputting depunctured data;

38 (5) second combining means for combining said depunctured data
39 output by said second depuncturing means, symbol by symbol in a unit of block,
40 and outputting a result of combining; and

41 (6) second convolutional decoding means for convolution-decoding
42 said result of combining,

43 wherein said transmission and reception system sets said
44 transmission frequencies approximately equal and selects said transmission
45 timings in a manner not to overlap among said plurality of transmission devices
46 with said first transmission control means, and executes transmissions in different
47 timings with one another by punctured-convolution-coding said information data
48 individually with different puncturing patterns when transmitting said series of
49 identical information data by said plurality of transmission devices.

1 10. The transmission and reception system according to claim 9,
2 wherein said transmission device is further comprising:

3 (1) second transmission control means, in which transmission
4 timings are set to be approximately equal and transmission frequencies are
5 selected in a such manner not to overlap among said plurality of transmission
6 devices, and said receiving device is further comprising

7 second reception control means, in which reception timings and
8 reception frequencies are set in advance to correspond with said transmission
9 timings and said transmission frequencies of said second transmission control
10 means.

1 11. The transmission and reception system according to claim 9,
2 wherein said transmission device is further comprising:

3 third transmission control means, in which both transmission timings
4 and transmission frequencies are set in advance in a such manner not to overlap
5 among said plurality of transmission devices; and said receiving device is further
6 comprising

7 third reception control means, in which reception timings and
8 reception frequencies are set in advance to correspond with said transmission
9 timings and said transmission frequencies of said third transmission control
10 means.

1 12. A transmission and reception system according to claim 1,
2 including a transmission device comprising:

3 (1) a second convolutional coding means for convolution-coding and
4 outputting said input data;

5 (2) first puncturing pattern generation means for generating a
6 puncturing pattern having an identical puncturing rate, but different in block
7 pattern from a puncturing pattern generated in any other of said plurality of
8 transmission devices;

9 (3) second puncturing means for puncturing a series of convolution-
10 coded data output by said second convolutional coding means by using the
11 puncturing pattern supplied by said first puncturing pattern generation means, and
12 outputting a series of punctured data;

13 (4) first transmission control means for outputting information of a
14 predetermined transmission timing and a predetermined transmission frequency
15 for said transmission device to execute a transmission; and

16 (5) first modulation / transmission means for modulating and
17 transmitting said series of punctured data in response to said information of
18 transmission timing and transmission frequency, and

19 and a receiving device comprising:

20 (1) first reception control means for supplying information of a

21 predetermined reception timing and a predetermined reception frequency for
22 carrying out reception of individual signals transmitted by said plurality of
23 transmission devices in said predetermined transmission timing and said
24 predetermined transmission frequency;

25 (2) first reception / demodulation means for receiving and
26 demodulating the signal transmitted by each of said transmission devices in
27 response to information of said predetermined reception timing and said
28 predetermined reception frequency supplied from said first reception control
29 means, and outputting demodulated data;

30 (3) third multiple puncturing pattern generation means for generating
31 puncturing patterns, which are identical to the individual puncturing patterns of
32 said plurality of transmission devices;

33 (4) second depuncturing means for depuncturing each of the
34 demodulated data output by said first reception / demodulation means by using a
35 puncturing pattern that is identical to the one used by said transmission device
36 among said puncturing patterns supplied from said third multiple puncturing
37 pattern generation means, and outputting depunctured data;

38 (5) second combining means for combining said depunctured data
39 output by said second depuncturing means, symbol by symbol in a unit of block,
40 and outputting a result of combining; and

41 (6) second convolutional decoding means for convolution-decoding
42 said result of combining,

43 wherein said transmission and reception system sets said
44 transmission frequencies approximately equal and selects said transmission
45 timings in a manner not to overlap among said plurality of transmission devices

46 with said first transmission control means, and executes transmissions in different
47 timings with one another by punctured-convolution-coding said information data
48 individually with different puncturing patterns when transmitting said series of
49 identical information data by said plurality of transmission devices

50 fourth transmission control means, in which both transmission
51 timings and transmission frequencies are set in advance to be approximately equal
52 among said plurality of transmission devices;

53 (2) said first modulation / transmission means are replaced by
54 second code division multiplex signal transmission means for modulating and
55 transmitting said series of punctured data output by said second puncturing means
56 with code division multiplexing in response to information of transmission timings
57 and transmission frequencies supplied from said fourth transmission control
58 means;

59 and said receiving device is further comprising:

60 (3) said first reception control means in said reception device is
61 replaced by a fourth reception control means, in which reception timings and
62 reception frequencies are set in advance to correspond with said transmission
63 timings and said transmission frequencies of said fourth transmission control
64 means; and

65 (4) said first reception / demodulation means is replaced by a second
66 code division multiplex signal reception means for receiving and demodulating a
67 plurality of transmission signals transmitted with said code-division multiplexing
68 by way of a despreading process according to information of said reception
69 timings and said reception frequencies supplied from said fourth reception control
70 means, and outputting an individual series of extracted demodulated data.

1 13. A transmission and reception system, comprising a transmission
2 device, a plurality of receiving devices for receiving a signal output by said
3 transmission device, and an output processing device for accumulating series of
4 data received in said plurality of receiving devices, said transmission device
5 comprising:

6 (1) third convolutional coding means for outputting input data by
7 convolution-coding said data;

8 (2) fourth multiple puncturing pattern generation means for
9 generating and outputting puncturing patterns having an identical puncturing rate,
10 but different in block pattern of puncturing with one another;

11 (3) third puncturing means for puncturing convolution-coded data
12 output by said third convolutional coding means by using each of said puncturing
13 patterns supplied by said fourth multiple puncturing pattern generation means, and
14 outputting punctured data;

15 (4) fifth transmission control means for outputting information of
16 transmission timing and transmission frequency for said transmission device; and

17 (5) second modulation / transmission means for modulating and
18 transmitting each of said punctured data supplied from said third puncturing
19 means in response to the information of said transmission timing and said
20 transmission frequency supplied from said fifth transmission control means,

21 each of said plurality of receiving devices comprising:

22 (1) fifth reception control means for outputting information of a
23 transmission timing and a transmission frequency for carrying out reception of
24 individual transmission signals addressed to each of said receiving devices out of a

25 plurality of signals transmitted by said transmission device in said transmission
26 timing and said transmission frequency;

27 (2) second reception / demodulation means for executing reception
28 and demodulation according to information of said reception timing and said
29 reception frequency supplied from said fifth reception control means, and
30 outputting demodulated data;

31 (3) second puncturing pattern generation means for generating a
32 puncturing pattern, which is identical to the one used in the transmission
33 addressed to each of said receiving devices out of said puncturing patterns
34 generated by said fourth multiple puncturing pattern generation means; and

35 (4) third depuncturing means for depuncturing said demodulated data
36 by using the puncturing pattern supplied by said second puncturing pattern
37 generation means, and outputting a series of depunctured data, and

38 said output processing device comprising:

39 (1) third combining means for combining said depunctured data
40 obtained by each of said plurality of receiving devices, symbol by symbol in a
41 unit of block; and

42 (2) third convolutional decoding means for convolution-decoding a
43 result of combining output by said third combining means,

44 wherein the information of said transmission timings supplied by
45 said fifth transmission control means are arranged in a such manner that said
46 individual transmissions do not overlap, and that the information of said
47 transmission frequency are approximately equal among said individual
48 transmissions.

1 14. A transmission and reception system, comprising a transmission
2 device, a plurality of receiving devices for receiving a signal output by said
3 transmission device, and an output processing device for accumulating series of
4 data received in said plurality of receiving devices, said transmission device
5 comprising:

6 (1) third convolutional coding means for outputting input data by
7 convolution-coding said data;

8 (2) fourth multiple puncturing pattern generation means for
9 generating and outputting puncturing patterns having an identical puncturing rate,
10 but different in block pattern of puncturing with one another;

11 (3) third puncturing means for puncturing convolution-coded data
12 output by said third convolutional coding means by using each of said puncturing
13 patterns supplied by said fourth multiple puncturing pattern generation means, and
14 outputting punctured data;

15 (4) sixth transmission control means, in which individual
16 transmission timings are set to be approximately equal and transmission
17 frequencies are selected in a such manner not to overlap among individual
18 transmissions of a predetermined number of times, in advance; and

19 (5) second modulation / transmission means for modulating and
20 transmitting each of said punctured data supplied from said third puncturing
21 means in response to the information of said transmission timing and said
22 transmission frequency supplied from said fifth transmission control means,

23 each of said plurality of receiving devices comprising:

24 sixth reception control means, in which reception timings and

25 reception frequencies for each of said receiving devices are set in advance to
26 correspond with said transmission timings and said transmission frequencies
27 assigned for individual receiving devices in said sixth transmission control means.

28 (2) second reception / demodulation means for executing reception
29 and demodulation according to information of said reception timing and said
30 reception frequency supplied from said fifth reception control means, and
31 outputting demodulated data;

32 (3) second puncturing pattern generation means for generating a
33 puncturing pattern, which is identical to the one used in the transmission
34 addressed to each of said receiving devices out of said puncturing patterns
35 generated by said fourth multiple puncturing pattern generation means; and

36 (4) third depuncturing means for depuncturing said demodulated data
37 by using the puncturing pattern supplied by said second puncturing pattern
38 generation means, and outputting a series of depunctured data, and

39 said output processing device comprising:

40 (1) third combining means for combining said depunctured data
41 obtained by each of said plurality of receiving devices, symbol by symbol in a
42 unit of block; and

43 (2) third convolutional decoding means for convolution-decoding a
44 result of combining output by said third combining means,

45 wherein the information of said transmission timings supplied by
46 said fifth transmission control means are arranged in a such manner that said
47 individual transmissions do not overlap, and that the information of said
48 transmission frequency are approximately equal among said individual

49 transmissions

1 15. A transmission and reception system, comprising a transmission
2 device, a plurality of receiving devices for receiving a signal output by said
3 transmission device, and an output processing device for accumulating series of
4 data received in said plurality of receiving devices, said transmission device
5 comprising:

6 (1) third convolutional coding means for outputting input data by
7 convolution-coding said data;

8 (2) fourth multiple puncturing pattern generation means for
9 generating and outputting puncturing patterns having an identical puncturing rate,
10 but different in block pattern of puncturing with one another;

11 (3) third puncturing means for puncturing convolution-coded data
12 output by said third convolutional coding means by using each of said puncturing
13 patterns supplied by said fourth multiple puncturing pattern generation means, and
14 outputting punctured data;

15 (4) seventh transmission control means, in which both transmission
16 timings and transmission frequencies are set in advance in a such manner not to
17 overlap among individual transmissions of a predetermined number of times; and

18 (5) second modulation / transmission means for modulating and
19 transmitting each of said punctured data supplied from said third puncturing
20 means in response to the information of said transmission timing and said
21 transmission frequency supplied from said fifth transmission control means,

22 each of said plurality of receiving devices comprising:

23 (1) seventh reception control means, in which reception timings and

24 reception frequencies for each of said reception devices are set in advance to
25 correspond with said transmission timings and said transmission frequencies
26 assigned to each of said reception devices in said seventh transmission control
27 means

28 (2) second reception / demodulation means for executing reception
29 and demodulation according to information of said reception timing and said
30 reception frequency supplied from said fifth reception control means, and
31 outputting demodulated data;

32 (3) second puncturing pattern generation means for generating a
33 puncturing pattern, which is identical to the one used in the transmission
34 addressed to each of said receiving devices out of said puncturing patterns
35 generated by said fourth multiple puncturing pattern generation means; and

36 (4) third depuncturing means for depuncturing said demodulated data
37 by using the puncturing pattern supplied by said second puncturing pattern
38 generation means, and outputting a series of depunctured data, and

39 said output processing device comprising:

40 (1) third combining means for combining said depunctured data
41 obtained by each of said plurality of receiving devices, symbol by symbol in a
42 unit of block; and

43 (2) third convolutional decoding means for convolution-decoding a
44 result of combining output by said third combining means,

45 wherein the information of said transmission timings supplied by
46 said fifth transmission control means are arranged in a such manner that said
47 individual transmissions do not overlap, and that the information of said

48 transmission frequency are approximately equal among said individual
49 transmissions

1 16. A transmission and reception system, comprising a transmission
2 device, a plurality of receiving devices for receiving a signal output by said
3 transmission device, and an output processing device for accumulating series of
4 data received in said plurality of receiving devices, said transmission device
5 comprising:

6 (1) third convolutional coding means for outputting input data by
7 convolution-coding said data;

8 (2) fourth multiple puncturing pattern generation means for
9 generating and outputting puncturing patterns having an identical puncturing rate,
10 but different in block pattern of puncturing with one another;

11 (3) third puncturing means for puncturing convolution-coded data
12 output by said third convolutional coding means by using each of said puncturing
13 patterns supplied by said fourth multiple puncturing pattern generation means, and
14 outputting punctured data;

15 (4) eighth transmission control means, in which both transmission
16 timings and transmission frequencies are set to be approximately equal among
17 individual transmissions of a predetermined number of times;

18 (5) third code division multiplex signal transmission means for
19 modulating and transmitting said punctured data with code division multiplexing
20 in response to information of transmission timings and transmission frequencies
21 supplied from said eighth transmission control means;

22 each of said plurality of receiving devices comprising:

23 (1) eighth reception control means, in which reception timing and
24 reception frequency for each of said reception devices are set to correspond with
25 said transmission timings and said transmission frequencies of said eighth
26 transmission control means; and

27 (2) third code division multiplex signal reception means for
28 receiving and demodulating said signals transmitted with code-division
29 multiplexing by extracting only a signal addressed to each of said receiving
30 devices according to information of the reception timings and the reception
31 frequencies supplied from said eighth reception control means, and outputting
32 demodulated data.

33 (3) second puncturing pattern generation means for generating a
34 puncturing pattern, which is identical to the one used in the transmission
35 addressed to each of said receiving devices out of said puncturing patterns
36 generated by said fourth multiple puncturing pattern generation means; and

37 (4) third depuncturing means for depuncturing said demodulated data
38 by using the puncturing pattern supplied by said second puncturing pattern
39 generation means, and outputting a series of depunctured data, and

40 said output processing device comprising:

41 (1) third combining means for combining said depunctured data
42 obtained by each of said plurality of receiving devices, symbol by symbol in a
43 unit of block; and

44 (2) third convolutional decoding means for convolution-decoding a
45 result of combining output by said third combining means,

46 wherein the information of said transmission timings supplied by

47 said fifth transmission control means are arranged in a such manner that said
48 individual transmissions do not overlap, and that the information of said
49 transmission frequency are approximately equal among said individual
50 transmissions:

1 17. A transmission and reception system further comprising a
2 transmission earth station, a receiving earth station, and a plurality of satellite
3 repeater stations, wherein communication is made from said transmission earth
4 station to said receiving earth station via said plurality of satellite repeater
5 stations, said transmission earth station being provided with an earth station
6 transmission device comprising:

7 (1) fourth convolutional coding means for outputting input data by
8 convolution-coding said data;

9 (2) fifth multiple puncturing pattern generation means for generating
10 puncturing patterns having an identical puncturing rate, but different in block
11 pattern of puncturing with one another;

12 (3) fourth puncturing means for puncturing convolution-coded data
13 output by said fourth convolutional coding means by using each of said puncturing
14 patterns supplied by said fifth multiple puncturing pattern generation means, and
15 outputting punctured data; and

16 (4) earth station modulation / transmission means for transmitting
17 each of said punctured data output by said fourth puncturing means to said
18 plurality of satellite repeater stations, one series of data after another, and

19 said receiving earth station being provided with an earth station
20 reception device comprising:

21 (1) earth station reception / demodulation means for receiving
22 individual signals transmitted from said transmission earth station via said
23 plurality of satellite repeater stations, and outputting of demodulated data;

24 (2) sixth multiple puncturing pattern generation means for generating
25 puncturing patterns, which are identical to the puncturing patterns of said fifth
26 multiple puncturing pattern generation means;

27 (3) fourth depuncturing means for depuncturing each of said
28 demodulated data output from said earth station reception / demodulation means
29 by using each of said puncturing patterns supplied by said sixth multiple
30 puncturing pattern generation means, and outputting the depunctured data;

31 (4) fourth combining means for combining the depunctured data
32 output by said fourth depuncturing means, symbol by symbol in a unit of block,
33 and outputting a result of combining; and

34 (5) fourth convolutional decoding means for convolution-decoding
35 said result of combining output by said fourth combining means, and outputting a
36 decoded data,

37 wherein said satellite-path diversity transmission and reception
38 system punctured-convolution-codes identical series of information data with
39 different forms of puncturing patterns, and executes path-diversity transmission
40 and reception of an obtained plurality of different series of error-correction code
41 word, as individual diversity branch data via said plurality of satellite repeater
42 stations.

1 18. A transmission and reception system further comprising a
2 plurality of earth stations and a plurality of satellite repeater stations, wherein said
3 plurality of earth stations communicate with one another via said plurality of

4 satellite repeater stations, and each of said plurality of earth stations comprises an
5 earth station transmission device comprising:

6 (1) fourth convolutional coding means for outputting input data by
7 convolution-coding said data;

8 (2) fifth multiple puncturing pattern generation means for generating
9 puncturing patterns having an identical puncturing rate, but different in block
10 pattern of puncturing with one another;

11 (3) fourth puncturing means for puncturing convolution-coded data
12 output by said fourth convolutional coding means by using each of said puncturing
13 patterns supplied by said fifth multiple puncturing pattern generation means, and
14 outputting punctured data; and

15 (4) earth station modulation / transmission means for transmitting
16 each of said punctured data output by said fourth puncturing means to said
17 plurality of satellite repeater stations, one series of data after another, and

18 an earth station reception device comprising:

19 (1) earth station reception / demodulation means for receiving
20 individual signals transmitted from said transmission earth station via said
21 plurality of satellite repeater stations, and outputting of demodulated data;

22 (2) sixth multiple puncturing pattern generation means for generating
23 puncturing patterns, which are identical to the puncturing patterns of said fifth
24 multiple puncturing pattern generation means;

25 (3) fourth depuncturing means for depuncturing each of said
26 demodulated data output from said earth station reception / demodulation means
27 by using each of said puncturing patterns supplied by said sixth multiple

28 puncturing pattern generation means, and outputting the depunctured data;

29 (4) fourth combining means for combining the depunctured data
30 output by said fourth depuncturing means, symbol by symbol in a unit of block,
31 and outputting a result of combining; and

32 (5) fourth convolutional decoding means for convolution-decoding
33 said result of combining output by said fourth combining means, and outputting a
34 decoded data,

35 wherein said satellite-path diversity transmission and reception
36 system punctured-convolution-codes identical series of information data with
37 different forms of puncturing patterns, and executes path-diversity transmission
38 and reception of an obtained plurality of different series of error-correction code
39 word, as individual diversity branch data via said plurality of satellite repeater
40 stations.

1 19. A transmission device comprising:

2 (1) convolutional coding means for convolution-coding input data,
3 and outputting convolution-coded data;

4 (2) a puncturing means for puncturing said series of convolution-
5 coded data using puncturing patterns, and outputting punctured data; and

6 (3) modulation / transmission means for modulating and transmitting
7 said punctured data.

1 20. A receiving device comprising:

2 (1) reception / demodulation means for receiving and demodulating
3 a signal transmitted by a transmission source via a communication pathway, and

4 outputting demodulated data;

5 (2) depuncturing means for depuncturing said demodulated data
6 using puncturing patterns that are identical to what have been used by said
7 transmission source, and outputting a plural variety of series of depunctured data;

8 (3) combining means for combining said depunctured data, and
9 outputting a result of combining; and

10 (4) convolutional decoding means for convolution-decoding said
11 result of combining, and outputting a decoded data.

1 21. A transmission and reception device comprising a transmitter
2 and a receiver, said transmitter comprising:

3 (1) convolutional coding means for convolution-coding input data,
4 and outputting convolution-coded data;

5 (2) puncturing means for puncturing said series of convolution-coded
6 data by using puncturing patterns, and outputting punctured data; and

7 (3) modulation / transmission means for modulating and transmitting
8 said punctured data, and

9 said receiver comprising:

10 (1) reception / demodulation means for receiving and demodulating
11 a signal transmitted by a transmission source via a communication pathway, and
12 outputting demodulated data;

13 (2) depuncturing means for depuncturing said demodulated data
14 using puncturing patterns that are identical to what have been used by said
15 transmission source, and outputting depunctured data;

16 (3) combining means for combining said depunctured data, and
17 outputting a result of combining; and

18 (4) convolutional decoding means for convolution-decoding said
19 result of combining, and outputting decoded data.

1 22. A method of transmission and/or reception comprising at least
2 one of a process (a) and a process (b), said process (a) comprising the steps of:

3 (1) convolution-coding input data, and outputting convolution-coded
4 data;

5 (2) puncturing said convolution-coded data by using puncturing
6 patterns, and outputting punctured data; and

7 (3) modulating and transmitting said of punctured data via at least
8 one communication pathway, and

9 said process (b) comprising the steps of:

10 (1) receiving and demodulating a signal transmitted via said
11 communication pathway, and outputting demodulated data;

12 (2) depuncturing said demodulated data by using puncturing patterns
13 that are identical to said puncturing patterns used in said step of puncturing, and
14 outputting depunctured data;

15 (3) combining said depunctured data, and outputting a result of
16 combining; and

17 (4) convolution-decoding said result of combining, and outputting
18 decoded data.

1 23. A transmission and reception system according to claim 1,
2 wherein said depuncturing means uses puncturing patterns which are used by said
3 puncturing means.

1 24. The transmission and reception system according to claim 9,
2 wherein said transmission device is further comprising:

3 (1) first reception control means for supplying information of a
4 predetermined reception timing and a predetermined reception frequency for
5 carrying out reception of individual signals transmitted by said plurality of
6 transmission devices in said predetermined transmission timing and said
7 predetermined transmission frequency;

8 and said receiving device is further comprising:

9 (2) first reception / demodulation means for receiving and
10 demodulating the signal transmitted by each of said transmission devices in
11 response to information of said predetermined reception timing and said
12 predetermined reception frequency supplied from said first reception control
13 means, and outputting demodulated data.